TREATMENT BY GENERATOR

TREATMENT-SPECIFIC GUIDANCE:

Carbon Adsorption

Ecology Fact Sheet *Publication Number 96-415 Revised December 2002*

This document may be used by generators interested in treating their own waste by carbon adsorption, on-site, in accumulation tanks or containers.[1] Generators of hazardous waste who comply with these standards, and the standards in Technical Information Memorandum (TIM) #96-412, *Treatment by Generator*, will meet the requirements of the *Dangerous Waste Regulations*, Chapter 173-303 WAC.

This Fact Sheet provides guidance only for treatment by generator. If treatment is done according to this guidance document, a permit or other written approval is not necessary.

Description and Definitions

The adsorption process uses forces of molecular attraction to bind soluble and gaseous chemicals to a surface. The process retains and accumulates toxic chemicals present in wastes, yet does not chemically alter them. Carbon used for adsorption is usually treated (activated) to make it very porous. Activated carbon has a large surface area that can adsorb relatively large quantities of material per unit weight of carbon. Activated carbon is "spent" when it has adsorbed so much contaminant that its adsorptive capacity is severely depleted.

Two types of activated carbon are: powdered activated carbon (PAC) and granular activated carbon (GAC). PAC is added to industrial wastewater sludge systems to adsorb toxics and in some cases, as a secondary effect, biodegrade compounds. Spent PAC is difficult to regenerate and usually must be disposed. GAC is generally placed in vessels that form a filter "bed". A GAC bed treats a liquid or aqueous solution/mixture by passing it through the bed. GAC can generally be regenerated.

Carbon adsorption processes produce three wastes: a treated effluent, a backwash effluent (backwashing disengages solids that have been entrapped in the bed), and a spent carbon residual.

Applicability

Carbon adsorption can be effective as a stand-alone treatment or as part of a treatment train, usually as a pretreatment for other processes. Carbon

[1]Carbon in certain configurations may also function as a filter. Refer to Fact Sheet #96-413, Filtration.

adsorption may be used to remove toxic constituents such as metals, organic solvents, and organic and inorganic compounds from waste streams (see Case Example below).

Organic compounds

Readily Adsorbable -

- Aromatic Solvents - benzene, toluene, nitrobenzenes
- Chlorinated Aromatics - PCBs, chlorobenzenes, chloronaphthalene
- Phenol and Chlorophenols
- Polynuclear Aromatics - acenaphthene, benzopyrenes
- Pesticides and Herbicides - DDT, aldrin, chlordane, BHCs, heptachlor
- Chlorinated Nonaromatics - carbon tetrachloride, chloroalkyl ethers, hexachlorobutadiene
- High-molecular weight Hydrocarbons - dyes, gasoline, amines, humics

Poorly Adsorbable -

- Alcohols
- Low molecular weight ketones
- Acids and aldehydes
- Sugars and starches
- Very high molecular weight or colloidal organics
- Low molecular weight aliphatics

Inorganic compounds

High Adsorption Potential

- Chlorine
- Bromine
- Iodine
- Fluoride

Low Adsorption Potential

- nitrate
- phosphate
- chloride
- bromide
- iodide

Metals:

High Adsorption Potential

- Antimony
- Arsenic
- Bismuth
- Chromium
- Tin

Good Adsorption Potential

- Silver
- Mercury
- Cobalt
- Zirconium

Fair or Low Adsorption Potential

- Lead
- Nickel
- Titanium
- Vanadium
- Iron
- Copper
- Cadmium
- Zinc
- Barium
- Selenium
- Molybdenum
- Manganese
- Tungsten
- Radium

If the department determines that the treatment process poses a threat to public health or the environment, the generator may be required to obtain a treatment permit. If the treatment is part of a wastewater treatment operation [regulated by Permit by Rule (PBR)], or the waste is being treated to meet Land Disposal Restriction (LDR) standards, please see "Other Regulatory Requirements", below.

This document is intended solely as guidance. It addresses only the requirements of the *Dangerous Waste Regulations*. The generator is still ultimately responsible for complying with all applicable federal, state and local requirements relating to on-site waste management. Based on the analysis of specific site circumstances, Ecology officials may require a generator to manage their waste in a manner other than as specified in this guidance. Ecology may also revise this Fact Sheet at any time.

Criteria

The following criteria apply in addition to the guidance in the TIM #96-412:

1) Any treated effluent and backwash from the process is managed in accordance with appropriate state or federal regulations.

2) The spent carbon is either regenerated in a safe manner without discharge of hazardous waste to the air, or designated and handled as hazardous or non-hazardous waste accordingly.

3) There are no spills or releases from the operation to the environment; and if there are, they are cleaned up immediately.

4) All equipment is decontaminated as needed.

Additionally, a carbon adsorption system's design must consider the carbon's ability to adsorb contaminants from a particular waste stream. It must maintain a minimum contact time to allow the contaminants to be adsorbed.

Other Regulatory Requirements

More detailed information on this guidance, or other mechanisms for treatment by generator if this guidance does not apply, is found in Technical Information Memorandum (TIM) #96-412, *Treatment By Generator*. Generators must assure compliance with all applicable sections of the *Dangerous Waste Regulations*, Chapter 173-303 WAC, such as proper designation of waste(s); accumulation, handling and labeling standards; reporting standards; spills and discharge requirements; etc. Information on appropriate

permit by rule and LDR requirements may be found in the TIM. In addition, the generator must comply with all other applicable federal, state and local regulations.

Case Example

A generator has a container of chromium contaminated rinsewater. Activated carbon is added to the waste and after thorough mixing it is allowed it to settle. The water is then used for the rinsing operation and the carbon is either regenerated or designated and sent for proper disposal.

Ecology Assistance

For more information please contact a hazardous waste specialist at one of the following Ecology offices:

Northwest Regional Office	425-649-7000
Southwest Regional Office	360-407-6300
Central Regional Office	509-575-2490
Eastern Regional Office	509-329-3400
Industrial Section	360-407-6916
Nuclear Waste	360-407-7100

Ecology is an equal opportunity agency. If you have special accommodation needs, or require this document in an alternate format, please call the Hazardous Waste and Toxics Reduction Program at (360) 407-6700 (Voice) or 711 or (800) 833-6388 (TTY).